AUSTRALIAN CROCODILES

In terms of conservation and public acceptance, Australian reptiles, and crocodiles in particular, tend to suffer in comparison with more appealing native fauna. Western Australia undoubtedly leads all other States in the conservation of reptiles in general, but the abyssmal lack of informative literature written for lay consumption has done nothing to alleviate the misconceptions and lack of understanding of crocodiles. We are therefore pleased to be able to reproduce the following excellent article by Dr. H. Robert Bustard which appeared in "Australian Natural History" Vol. 17, No. 5. Dr. Bustard is a population ecologist working at the Research School of Biological Sciences of the Australian National University and is Australia's leading authority on crocodiles.

"Crocodiles are one of the most maligned animal groups. They are widely loathed, very little understood by most people and surrounded by a number of myths. In this article I hope to be able to convince the reader that crocodiles have a place in nature and are no more than a master predator in their environment, as is a lion in his habitat.

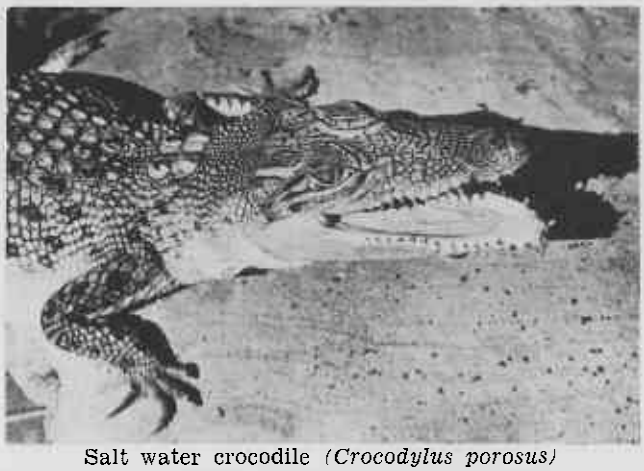
In Australia there are two species of crocodile, the Freshwater or Johnston's Crocodile *(Crocodylus johnstoni)* and the Saltwater or Estuarine Crocodile (*Crocodylus porosus*). These two species illustrate a number of points which have been central to evolution and distribution of the crocodile group. There has been a radiation or evolution in two main directions, namely, the development of long-snouted species with slender jaws and of short-snouted, broad-jawed species. The Australian freshwater species and the estuarine crocodile are representatives of these two groupings respectively. The distribution of freshwater crocodiles is usually closely circumscribed, since saltwater forms a barrier to their dispersal. Hence, adjacent areas of the world separated by even a narrow area of sea may have evolved quite distinct freshwater crocodiles. Such is the case in Australia and Papua-New Guinea. The Australian Freshwater Crocodile is found only in Australia. In Papua-New Guinea there is also a freshwater crocodile *(Crocodylus novaeguineae)*, but even the novice could readily distinguish it from the Australian freshwater species.

The saltwater crocodiles on the other hand, like many seagoing animals, have been able to disperse and colonize other suitable habitats. Probably no crocodile has been as successful at this as the estuarine species (*C. porosus*). This crocodile is widely distributed in Asia from the Indian subcontinent eastwards, and extends southwards through the Malay peninsula and Indonesia to northern Australia. It often occurs on fairly small, remotely-placed Pacific islands having, for instance, been recorded at least once in the Fiji Islands, which are thousands of miles from any substantial land-mass.

Crocodiles "unpopular"

Crocodiles are reptiles, as are lizards, snakes, tortoises, turtles, and the remarkable New Zealand tuatara (*Sphenodon*). This may in large measure explain why they enjoy such low public esteem, as the general public tend to dislike reptiles, and, since they are ill-informed about them, credit them with many harmful or unpleasant habits. Hence a crocodile, which is master of its river system or swampland, is seen as a foul beast, whereas the lion is called "King of Beasts".

Like other members of the class Reptilia, crocodiles have a long and distinguished history. They are descended from prehistoric reptiles called archosaurs—ancestral also to the dinosaurs, and somewhat like them in living pattern. The crocodiles have continued to occupy the same life style for 170 million years. There is a temptation to think that in evolution the new is always replacing the old. This is far from always being the case, and the crocodile group provides an excellent example of a group of animals which in far-back antiquity evolved a way of life that made them supreme in their chosen habitat and allowed them to remain masters of their environment throughout 170 million years. It must be remembered that, until the advent of shooting with modern automatic weapons, crocodiles could be seen in almost unbelievable numbers throughout tropical swamplands and river systems.



Salt water crocodile *(Crocodylus porosus)*

Like most reptiles, crocodiles do not thrive under cool conditions. For this reason they are restricted to the tropics, in Australia being found only in the north, occurring in Western Australia, the Northern Territory, and Queensland. In Western Australia they are restricted to the Kimberley Division. They occupy a similar portion of the "top-end" of the Northern Territory, but in Queensland the estuarine species formerly ranged much further south along the coast, well into central Queensland. Human expansion and shooting have all but exterminated these more southerly populations.

Freshwater or Johnston's crocodile *(Crocodylus johnstoni)*

All crocodiles are semi-aquatic, and show adaptations to their way of life. The eyes and nostrils (see the accompanying photos) are placed well up on top of the head so that the crocodile can swim or float with only the eyes and nostrils exposed. There is a fleshy flap at the back of the mouth which cuts off the throat so that crocodiles can open their mouths under water without drowning. The rear feet are webbed and the tail, the main organ of propulsion, is flattened laterally to make a powerful paddle. When swimming, all four limbs are folded back along the body. Crocodiles' jaws are well equipped with sharp teeth to hold the prey. This is particularly important with slippery prey such as fish, which forms an important part of the diet of all species at least during part of their life.

Life cycle

The life-cycle of crocodiles follows the classical dinosaur pattern. They begin life as eggs which have hard calcareous shells like those of birds. Not unnaturally there is considerable difference in egg size among the various species, but they approximate the size of goose eggs, though somewhat more elongated. The mother crocodile has to place the eggs somewhere where they will not run the risk of being flooded by rising water. Some crocodiles nest during high water levels, either in or immediately after the wet. They solve this problem by laying their eggs in nests which they construct in floating grass islands that rise and fall with the water (as is done by the Estuarine Crocodile). Others, of which the Australian freshwater species is an example, nest during the dry season, laying their eggs in sandbanks. The young of the latter species must emerge before the water-levels rise at the start of the next wet season. Emergence is usually timed so that the rising flood-waters serve to disperse the recently-hatched young, which would be extremely vulnerable if they were all cooped up in small dry-season pools. When they hatch, baby crocodiles are quite tiny, a total length, including the tail, of around 9 inches being usual, although of course, there are species differences. They are extremely vulnerable to a whole host of predators, including many fish, birds, reptiles and mammals which larger crocodiles themselves eat. Here again we see the dinosaur pattern. A life-history beginning with small eggs—even the largest crocodiles lay eggs which make an ostrich egg look enormous—and young which for some time are so small as to be virtually defenceless and must hide from their enemies, but which with growth eventually come to occupy a niche that no other species of animal can hope to challenge.

Parental care

Crocodiles have from time to time been stated to guard their eggs and even occasionally their young. For a long time this information was suspect and scientists thought that here was just another myth about crocodiles, especially since parental care is virtually unknown in reptiles. However, recent work, notably by H. B. Cott, a special adviser to the Governments of Uganda and Northern Rhodesia, has finally conclusively demonstrated that parental care does take place. The African crocodile *C. niloticus*, studied by Cott, not only guards the nest from egg-eating predators (as do many other species) but, according to Cott, plays a vital role in liberating the young from the nest and in guiding them to the nearest suitable water. When the young crocodiles are ready to leave the nest they call to the mother, who opens the nest. It appears that calling is also a key factor in synchronizing emergence by all the brood at the one time and in keeping them together with the mother. Cott has recently described "nurseries" in which the mother stays with the young, chasing away enemies until they are several months old.

Although juvenile crocodiles have many enemies, without man to disturb the balance crocodiles would always be numerous. This is because they are long-lived animals and require only a very low level of survival among their progeny to offset natural losses. Since they are master predators, losses will occur mainly from old age or fights with other crocodiles. It seems likely that crocodiles limit their numbers like other animal populations which have been studied and, indeed, as did man until he became a settled farmer. Crocodiles appear to do this by having "stations", or territories, each of which is occupied by an adult crocodile that will tend

to be an old individual. Since crocodiles, like other reptiles, grow throughout life, old is synonymous with large. Let us take an example from the Australian estuarine species. Although females very rarely exceed 14 feet, males certainly grow to at least 20 feet. Sexual maturity is reached between 8 and 9 feet. Just imagine the result of an encounter in which a hopeful young male of 9 feet and weighing several hundred pounds tries to dislodge an old male of twice his length, probably ten times his weight, and with perhaps a century's experience in the art of killing opponents!

Crocodile society is ultra-conservative and is an old crocodile's world. While it is true that until recently we lived in an old man's world, the difference is that the young crocodiles are killed off without having a chance to breed, breeding being a prerogative of "station"-owning crocodiles. In human society the younger men, although they may have to wait for power, are able to produce progeny throughout this period. With crocodiles, evolution is largely in the hands of crocodiles which have been successful for long periods of time. A conservative situation like this will tend to result in little change—which is reflected in the group remaining similar throughout a long period of geological time.

There are many aspects of crocodiles which deserve mention, but space precludes more than two. Crocodiles are carnivores and as they grow their diet changes from insects, tiny fish and frogs at birth, to larger fish, then other reptiles and birds, and in large individuals, mammals usually come to make up a large part of the diet. (This was beautifully illustrated by Cott in a publication in 1961). Crocodiles like fresh prey, and eat it at once. The idea that they keep food in underwater lairs until it is rotten is a myth. Crocodiles, incidentally, are not much interested in humans as food. This applies to large species well able to take a man. Even where contact is an everyday affair attacks are infrequent. Certainly the Estuarine Crocodile much prefers dogs or pigs to man. The Australian Freshwater Crocodile is a shy inoffensive little animal which will never attack humans unless attacked (wounded) first.

Conservation

I would like to finish this article with a plea for crocodile conservation. Those interested should read my 1969 article in *World Wildlife Year Book*. It would be tragic if such a fascinating group should be wiped out after such a long and proud history and before scientists have even had a chance to study them. Yet most species are threatened, and for some the only hope for the future lies in captive breeding studs. In Australia the situation is not yet so critical—due particularly to the foresight of Western Australia, which protects both species. However, since Queensland refuses to take any action, [see Crocodile Research in Queensland, S.W.A.N.S. Vol. 3 No. 1] poaching is rife as far away as Western Australia to sell skins in north Queensland. Incidentally, it would be quite possible to provide the commercial demand for crocodile leather from crocodile farms and leave the wild crocodiles to go their own way undisturbed as they have since Jurassic days.

By the time this article is in print Australia will have its first crocodile farms, run to benefit Aborigines, under my supervision, with financial backing from the Commonwealth Office of Aboriginal Affairs, apart from an attempt at Karumba which failed in the mid-1960's.

LEATHERY TURTLE AT BUSSELTON

Fauna Warden K. Morrison reports the capture of a rare Leathery Turtle at Busselton in January this year.

A local professional fisherman found the turtle entangled in the ropes of his shark net which he had set in 22 fathoms of water about 10 miles north of Cape Naturaliste. The turtle was handed over to the local Jaycees organisation, who run a large marine aquarium in Busselton, but due to its large size it threatened to damage the aquarium or harm itself, so on the following day it was released into the ocean, unharmed.

The turtle weighed approximately 500 lb., was about 5½ feet long and measured 8 feet across from flipper to flipper.

Leathery or Luth Turtle (Photograph by courtesy South West Times)

Leathery or Luth Turtles are only very occasional visitors to our coast, although they are the most widely distributed of all turtles. They are placed in a family of their own, for unlike all other marine turtles their carapace consists of many small plates embedded in a tough leathery skin and the backbone is not firmly attached to the carapace. The Leathery Turtle is second only in reptilian size to the Estuarine Crocodile, and grows to a length of more than 8 feet with a weight exceeding 1,500 lb. Seven prominent ridges extend along its back and five along its belly. The limbs are powerful clawless flippers, the front pair much longer than the rear. It is mainly a fish eating turtle, and the throat is lined with long spines to help hold its prey.

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